Laboratory Research Logistics – What is basic research and how do we support the lab?

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• What is basic laboratory research?
• Who works in a basic research lab?
• How do we equip and stock a lab to do basic cancer research?
• Where are the different sources of research funding?
• What does the grant writing process look like?
• How can advocates partner with researchers?
• What is the role of patient advocates in the grant review process?
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Basic science research develops the ideas that ultimately transform clinical care.

Basic cancer research uses “model systems” to mimic cancer in the lab.

We use models to test new ideas:

- Develop new diagnostics, biomarkers, therapies.
- Develop new therapeutics.
- Understand the molecular underpinnings of disease.
- Understand mechanisms of therapeutic resistance.
- Understand patient heterogeneity.
- Understand driver mutations.

“Incubators” help us keep cells in an environment similar to the body.

Let’s take a closer look in the microscope.

Patient-derived xenografts

- Implant patient tumor
- Treat mouse “avatar” with cancer drug
- Watch for tumor response, or study resistance mechanisms

Diagnostic and surgical patient tumor samples

- Treat cells with clinically used drugs
- Turn specific genes on and off
- “Break” genes or edit the genome
- Manipulate the environment
  - Oxygen levels
  - Nutrients
  - Growth signals
  - Steroid hormones
  - Neighbor cells
  - “3D” environment

What makes cancer cells grow and multiply?

How do cancer cells adapt to resist therapies?

What makes cancer cells different than “normal” cells?

What allows cancer cells to metastasize?
Conceptualize research

Get Funding

Do the research

Get more funding

Do more research

Present the research

Publish the research

Molecular Cancer Research

Defining the Molecular Basis of Metastasis and Progression

American Association for Cancer Research
How do unique “partner” proteins change ER function in ILC?

Fall 2016

ACS / UCCC Pilot
$30k

Jan. 2017

Do the research

Get more funding

Cancer League CO - $30k
RNA Biosciences - $10k
American Cancer Society - $700k

Sept. 2020

Present the research

Do more research

Pre-print 12/16/20
Submitted 1/11/21
Revised 3/31/21
Revised again 4/16/21
Accepted 4/28/21
Published 5/4/21

- U. Utah Seminar
- Local CU seminars
- U. Pitt Seminar
- FASEB Conf.
- Lobular2021
- ENDO2022

Funding to first publication: 4 y, 4 mo
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Basic Research Laboratory Personnel

- **Principal Investigator (PI)**
  - PhD/MD; Assistant Professor → Associate Professor → Professor
  - $80k - $200k / y based on level and additional admin roles

- **Staff scientist**
  - PhD; may be non-tenure track faculty
  - $60k - $100k / y

- **Graduate student**
  - BS/BA, MS; training for PhD (or MS)
  - $32k - $40k / y, + $5k - $15k / y tuition

- **Research Technician**
  - BS/BA, MS; may be lab manager
  - $35k - $90k / y, per expr / skillset

- **Postdoctoral Fellow**
  - PhD; ~training position after doctorate
  - $55k - $65k / y

- **Clinical Fellow**
  - MD; 12-18mo research during fellowship
  - Varies per fellowship setup

- **Trainees**
  - Undergraduates, Postbac fellows, Medical students, etc.

- **PIs are responsible for all** salary, tuition, & benefits via grants
Most research costs are personnel

How much does it cost to run a research laboratory?

- Personnel (Salary, Benefits, Tuition): $360,000 - $400,000 per year
- Research Supplies: $475,000 - $525,000 per year
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Supplying a basic cancer research laboratory

“Consumables”
- Plastics (tubes, flasks, tips, etc): varies
- Gloves: ~$50 / box (pandemic!!!)
- Pipettes: $200 - $300 each + annual maintenance
- Cell growth medium ($20 - $200 / L)
- Bovine serum for growth medium ($600 - $1500 / L)
- Purified growth factors ($ a lot)
- Antibodies ($300 - $500 “each”)
- Specialized experimental reagents, compounds, etc.
- Next-generation sequencing ($200+ / sample x dozens)
- “Core” equipment fees: $25 - $200 / hr
→ Total: ~$20k - $30k+ per person per year

“Capital equipment”
- Incubator: $6k - $10k each
- Biosafety cabinet: $12k - $20k
- Centrifuges: $5k - $20k each

In vivo (animal) studies
- One immunocomp. mouse = $80 - $120
- Housing: ~$1.10 / day / cage
  - One tumor study: 50 mice = $5,500
  - 10 cages x 8 weeks = $616

Publishing et al
- Publication fees: $1000 - $10000 / article
Costs add up rapidly even for new small labs

- **Tech hired:**
  - $40k/y salary,
  - $54k/y + fringe

- **Postdoc hired:**
  - $55k/y salary,
  - $70k/y + fringe

- **Grad Student joins:**
  - $34k/y salary,
  - $50k/y + tuition/fringe

- **Grad Student gets T32:**
  - ~85% coverage

*No add’l grants

- No equipment
- No animal studies
- No big ‘omics
- No PI salary

Personnel Supplies

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Sources of funding for cancer research

- New lab “start-up” funds from institution
  - Brand new labs (median $750k) or recruitments
- Federal: National Institutes of Health, Dept. of Defense
- Foundations: American Cancer Society, Susan G. Komen, state/regional foundations (Cancer League of CO, Dynami, LBCA)
- Philanthropy/Endowments: uncommon but critical; “grateful patients”, Lobular Breast Cancer Research Fund @ CU Anschutz
- Industry: clinical trials; “contract” research or deliverables focused, less common for basic research
*All grant funded research campus-wide, not limited to basic research
## Funding limitations slow research progress

National Cancer Institute “Research Project Grants”: ~$2,600,000,000 / yr

<table>
<thead>
<tr>
<th>Grant</th>
<th>Funding</th>
<th>Success Rate</th>
<th>Limited funding = Years in peer review and revision = 100’s of hours writing = Years between idea conception and research initiation</th>
</tr>
</thead>
<tbody>
<tr>
<td>NCI R01</td>
<td>$250k-400k / yr</td>
<td>10-11%</td>
<td></td>
</tr>
<tr>
<td>DoD BCRP</td>
<td>$125k-350k / yr</td>
<td>6-7%</td>
<td></td>
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<tr>
<td>ACS RSG</td>
<td>$165k / yr</td>
<td>‘queue’</td>
<td></td>
</tr>
<tr>
<td>Dr. Sikora (‘lifetime’ as PI)</td>
<td>~40 grants, ~$15.7million</td>
<td>11 grants, ~$1.8million (11.4%)</td>
<td></td>
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Grant writing and submission

Write grant
- Literature searching
- Constructing goals
- Build collaborative team
  - Drafting
- Feedback from colleagues

1 – 12+ months

Submit and Wait

4 – 12+ months

Revise & Resubmit

Receive reviews
- May or may not include funding decision

Peer Review

3 – 6 months

Awarded

Await “programmatic” reviews
0 – 3 months

Award Negotiation
- Paperwork
- “Indirect” funding
- Regulatory approvals

1 – 6 months

Submit and Wait

Funding!

Funded on the first try?
4-12 months

Via resubmission cycles?
Years
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Write grant
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Does the proposed research have the potential* to impact patient needs?
Are the proposed goals going to address a significant clinical concern for patients?
Are the proposed new interventions going to be tractable for patients?
Does the proposed research equitably serve different patient populations?
Will research outcomes be available to the patient/advocate community?
Will research outcomes be made accessible to the patient/advocate community?

Research Methods & Design
Research Communication & Outreach

- Reach out to local researchers directly or via regional NCI-designated Cancer Center
https://www.cancer.gov/research/infrastructure/cancer-centers/find
- Reach out via LBCA
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Consumer Involvement

"It is intellectually challenging and a big commitment. But that is part of what I like so much about serving as a Peer Reviewer. It’s hard work but you come away from it feeling as if you have made a significant contribution; it is incredibly rewarding."

- Linnea Duff, LCRP

The Congressionally Directed Medical Research Programs (CDMRP) welcomes patients, survivors, family members, and advocates to play a pivotal role in the future of biomedical research funding. To transform healthcare for our Service members and the American public, the CDMRP looks to those who have the most experience, who understand the effects of a disease, an injury, or a condition - the individuals (consumers) living with breast cancer, orthopedic injury, Parkinson’s disease, etc. By integrating patients, survivors, family members and/or caregivers into the scientific review process, the CDMRP is able to enrich the scientific review with personal perspective, passion, and a sense of urgency that ensures the human dimension is incorporated in the research focus. Over 2,000 consumers have served as Peer and Programmatic reviewers since 1995. By partnering with consumers, the CDMRP strives to find and fund collaborative research that discovers, develops, and delivers healthcare solutions for Service members, Veterans, and the America public.

https://cdmrp.army.mil/cwg/default
Thanks!

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